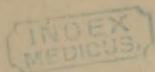


Sims (J. M.)

[COMPLIMENTS OF THE AUTHOR.]



THE BROMIDE OF ETHYL AS AN ANÆSTHETIC,

BY

J. MARION SIMS, M.D., LL.D.

(Read before the New York Academy of Medicine, March 18, 1880,

WITH DISCUSSION ON THE SAME BY

DRS. LEVIS (Philadelphia), SQUIBB, DALTON,

POST, PIFFARD, LITTLE, WYLIE, and

ROBERTS (Philadelphia).





THE BROMIDE OF ETHYL AS AN ANÆSTHETIC.*

BY J. MARION SIMS, M.D., LL.D., NEW YORK.

The bromide of ethyl is now making considerable reputation as an anæsthetic. According to Dr. Turnbull it was discovered by Serullas in 1827, but attracted no special attention till Dr. Thomas Nunnelly, of Leeds, made some experiments with it on animals in 1849. In 1865, Dr. Nunnelly brought the subject again before the profession by a paper read at the British Medical Association in which he says he had employed it as an anæsthetic "in all the principal operations at the Leeds General Eye and Ear Infirmary." This was at the time when chloroform held such complete sway in England that no importance was attached to Nunnelly's experience, and he had no followers.

In 1876 some experiments were made with it in France by Rabuteau on the lower animals, but without a knowledge of the fact that this had been done previously in England by Nunnelly.

To Dr. Lawrence Turnbull and Dr. R. J. Levis, of Philadelphia, we are indebted for what we know of the anæsthetic properties of the bromide of ethyl.

Dr. Turnbull began to experiment with it in September, 1877, using it first on himself, and then on his patients. After satisfying himself as to its efficiency and safety as an anæsthetic, he laid the subject before the Pennsylvania State Medical Society in 1878. In August, 1879, he brought it before the British Medical Association at Cork, and in September of the same year before the International Medical Congress at Amsterdam. In April, 1879, Dr. Turnbull had the good fortune to interest Dr. Levis in the subject. Dr. Turnbull's operations under the ethyl were mostly in

* Read before the New York Academy of Medicine, March 19th, 1880.

ophthalmic and aural surgery, and were generally of short duration. But Dr. Levis being surgeon to two large general hospitals (the Pennsylvania and the Jefferson Medical College Hospital), had ample opportunities of testing its qualities and proving its excellence as an anaesthetic in general surgery and in prolonged operations ; and through his influence and teachings at these hospitals it seems to be coming rapidly into common use.

The bromide of ethyl has been pronounced by Maisch and Stillé, and by Dr. Greene, of Philadelphia, to be hydrobromic ether.

There are two or three processes for making the hydrobromic ether. Our friend Dr. Squibb will explain them to you. The most economical is the phosphorus, alcohol and bromine one. The disagreeable odor belonging to the hydrobromic ether made by this process is supposed to be due to the phosphorus. Another process is by distilling absolute alcohol with about three times its weight of bromine. Another process consists in the combination of potash and bromine. Its formula is :

C_2H_5Br ; boiling-point, $105^{\circ} F.$; density, $1,419$ at $59^{\circ} F.$

Dr. Turnbull defines hydrobromic ether to be "a pure, colorless, very volatile liquid which evaporates with great rapidity on bibulous paper, leaving no residue, and having a strong ethereal odor which remains upon the patient's breath long after its use. It has a sweetish and hot taste. Its boiling-point is intermediate between that of chloroform and ordinary ether. It is sparingly soluble in water, but mixes with it, and in all proportions with alcohol and ether."

I here show you samples of it made by four different manufacturers in Philadelphia. That marked No. 1 was made by Wyeth & Bro., and is mostly used by surgeons in Philadelphia. You see how readily its vapor extinguishes a flame. No. 2 contains ether and ignites. These two have a peculiar but not disagreeable odor. Nos. 3 and 4 have a very strong, unpleasant odor, which is repulsive. This is the kind that was used by Turnbull and Levis before Wyeth made a better article.

It is claimed for hydrobromic ether that it produces

anæsthesia more rapidly than chloroform, and is eliminated from the system more rapidly by the lungs and kidneys than any other anæsthetic, and that it is less apt to produce vomiting than ether or chloroform.

It usually produces anæsthesia in two or three minutes—sometimes four ; and consciousness returns in two or three minutes after its administration ceases. It is given (according to Turnbull and Levis) “on a handkerchief or small napkin folded up to a space of about four inches square, and then laid on a larger napkin folded so as to be large enough to cover the entire face of the patient.”

About two drachms are poured on the napkin to begin with, and a drachm is added afterwards at intervals as required.

Hydrobromic ether has been administered in Philadelphia as an anæsthetic about two hundred times, and it is greatly lauded by all who have used it. Of course, this is a small experience upon which to base its absolute safety. Chloroform was administered to thousands of cases before we heard of a death from its use, and now we know that it has slain its hundreds.

Bichloride of methylene has been given by Spencer Wells' most extensively, perhaps a thousand times without accident, and yet a voice comes up from the profession saying that it is quite as dangerous as chloroform ; and outside of the personal influence of Spencer Wells it is rarely used in England, and has not been generally adopted elsewhere.

The profession have been for a long time in search of a new anæsthetic. We have been waiting for one as pleasant to take as chloroform and as safe as ether. When we are convinced that we have one answering this description, it will be heartily welcomed by the profession all over the world. Does the Turnbull-Levis anæsthetic come up to our expectations ? Time alone will show. It is the duty of every man who has had any experience with it to lay it before his brethren. With this obligation pressing heavily upon me, I came here to-night to lay my contribution on this important subject before you.

For my knowledge of the use of hydrobromic ether I am indebted to Dr. Levis. I made him a visit on the 28th of

January last, when he told me of his experience, gave me his paper on the subject, and gave me a bottle of the ether for experiment. I came home saturated with Dr. Levis's views. From his experience I felt quite convinced that we had at last found the long looked-for anæsthetic.

Three days after my visit to Dr. Levis I gave the hydrobromic ether to a young lady at St. Elizabeth's Hospital ; but, not understanding the proper method of administering it, I failed utterly to produce its anæsthetic effect. In eight minutes we had wasted eight drachms of the hydrobromic ether, and it produced only a stage of excitement in which the patient was wholly uncontrollable. I then laid it aside and resorted to ether. On the next day I gave it to a young lady, twenty years old, who was completely anæmic from menorrhagia which had continued many months. She was so exhausted from loss of blood that she occasionally had syncope, even in the recumbent posture. By the inhalation of two drachms of the hydrobromic ether given by Dr. Wylie she was completely anæsthetized in two minutes. The operation was performed in about five minutes, and she was placed in bed and recovered consciousness in two or three minutes more. I was so well pleased with the anæsthetic in this instance that I felt encouraged to give it further trial. The effect produced in this case differed widely from that in the first, and depended entirely upon the different methods of administration in the two cases. In the first, the bromide of ethyl was poured on a folded handkerchief, and held close to the mouth and nostrils, but not in absolute contact with them. In the second case, it was poured on a folded handkerchief and laid in contact with the mouth and nose, and held firmly there by a towel folded into a square of eight or ten inches. By this method no air could be breathed that was not loaded with the ethylic vapor. With this experience as a guide I determined to administer it in a case of Battey's operation.

Miss B———, twenty-five years old, in perfectly good health, had been subject to epileptic attacks for the last five years. They came regularly on the fourth or fifth day after the cessation of the menses. Menstruation was scan-

ty, lasting but two days. She had retroversion, and the right ovary was enlarged and painful on pressure.

Bromides had been largely used without any permanent improvement. The uterus had been replaced, but with no improvement ; afterwards the cervical canal was enlarged by incision ; then menstruation became normal in quantity and painless, and yet the post-menstrual epileptic seizures were not modified in the least. Her physicians, Dr. Betton and Dr. Bond, had advised Battey's operation, and from my failure to give her any relief by the tentative efforts just alluded to, I advised her to submit to Battey's operation, and it was performed on Monday, February 9, 1880.

Everything being ready, a drachm of bromide of ethyl was poured on a folded napkin and held closely over the mouth and nose. In a minute more another drachm was poured on the napkin, and at the end of two minutes she became insensible and relaxed ; but the conjunctiva was sensitive to the touch, and her eyes rolled about, and her breathing was very rapid. At the end of five minutes (the hydrobromic ether added as required) she was perfectly insensible and breathing sixty times a minute. This very rapid breathing would moderate whenever the ether-napkin was removed so as to allow the admission of pure air, and would always increase by pouring fresh ether on the napkin. At the end of ten minutes she could be kept quiet, breathing softly and regularly, but always above the normal standard. The pulse was now 86, full and strong. During the first twenty minutes we had used about two ounces of the hydrobromic ether. At that time she vomited freely. At the end of forty minutes she vomited again, with severe straining.

On three occasions during the operation there was considerable opisthotonus, with twitching and rigidity of the muscles of the extremities, and constant rolling of the eyes in every direction.

Dr. Nash thought these were similar to her epileptic attacks, in one of which he had seen her.

The operation lasted an hour and a half. Her condition was good during the whole time, and her pulse was strong and full. The rapid, short breathing was a peculiar feature;

the sensitiveness of the conjunctiva existed from the beginning to the end of the operation, and her eyeballs were in almost constant motion. There was no unusual dilatation of the pupils. In all, about four and a half or five ounces of ethyl were used.

She recovered quickly from the anaesthetic after being put to bed, but she had the most distressing retching and vomiting imaginable. The straining was so violent that Dr. Nash more than once placed his hands over the abdomen to prevent the wound from bursting asunder. From the moment of returning consciousness she complained of violent pain in the head, and to relieve this pain she got a fourth of a grain of morphine hypodermically. In an hour this was repeated. Two hours after the operation (6.30) the pulse was 60, full and strong.

6.15.—Distressing retching and vomiting continued almost uninterruptedly ever since the operation was finished. Headache very severe. Quarter-grain of morphine hypodermically for pain in head. One ounce of urine drawn by catheter.

7.30.—Nausea and retching, but no vomiting ; still has severe pain in head. Thin, yellowish brown movement from the bowels, watery, but a few ounces ; odor very offensive, having the smell of bromide of ethyl.

8 P.M.—Another movement from the bowels, the same character as the first.

9 P.M.—Another movement of the same brownish water ; each attended with some tenesmus.

9.30 P.M.—Milk and brandy, to be repeated at intervals.

10.15 P.M.—Two ounces of urine drawn ; bowels moved twice in the last hour. This makes five movements of bowels in three hours. The odor of the bromide of ethyl in the passages was so strong that it attracted the notice of the inmates of the house.

11 P.M.—Pulse, 117 ; temperature in axilla, $99\frac{8}{10}$ ° ; respiration, 25. Still complains of pain in the head ; small, brownish, watery discharge from the bowels, attended with tenesmus and mucus.

12.35 A.M., Tuesday, Feb. 10th.—Very restless ; complains of pain and desire to go to stool. Gave one-fifth grain of morphine hypodermically.

3.15 A.M.—Has slept since the administration of the morphine (2 h. 40 m.). Drew off two ounces of urine. Hiccough occasionally since 10 o'clock. Tenesmus and effort at movement of the bowels. Pulse, 125; temperature, 101° . Sleeping.

5 A.M.—Pulse very feeble. Stimulants.

5.30 A.M.—Pulse scarcely perceptible.

6 A.M.—Small, brownish, watery movement from the bowels, with tenesmus.

6.40 A.M.—Recurrence of hiccough; quietly sleeping; perfectly conscious when spoken to.

7 A.M.—I saw the patient and made the following note: pulse imperceptible; no pain except in head; somewhat restless. I fear internal hemorrhage, because the diarrhoea does not seem to have been sufficient to prostrate her to this extent. Her breath is highly charged with the ethyl odor. The movements from the bowels are brownish dirty water with some tenesmus and mucus. Passed a catheter into the sigmoid flexure and injected thirty grains of tannin and twenty drops of laudanum, which passed off immediately.

7.45 A.M.—Very restless; wishes to sit up; growing weaker; mind wandering.

8.40 A.M.—Catheter introduced, no urine in the bladder; pulse imperceptible. Respiration, 36; temperature, $102\frac{1}{10}^{\circ}$.

10.30 A.M.—Catheter introduced, teaspoonful of high-colored urine drawn.

11 A.M.—Severe convulsion, with frantic ravings. Convulsions ceased at 11.40 A.M., with heart-rending screams, and she died at 12.15 P.M., about twenty-one hours after operation.

Wednesday, Feb. 11, 1880, 8.45 A.M.—Post-mortem made (twenty hours after death) by Dr. S. Waterman, Dr. Waterman, Jr., and Dr. Nash. External wound three and a half inches long. Sutures (8) removed; edges of wound adherent throughout. Abdomen laid open by free incisions, longitudinal and transverse. Two and a half ounces of bloody serum in the peritoneal cavity, three drachms of it being in the Douglas pouch below the retroverted uterus. There was no exudation of lymph, and no signs of peritonitis.

The left broad ligament united to sigmoid flexure by old and strong adhesions were broken up, and then the uterus and broad ligaments were removed, together with the utero-sacral ligaments, a portion of bladder, and the upper part of vagina. The lower part of the ileum for about eighteen inches looked dark and congested, and about twelve inches of it were removed, severing it at the caput coli. The colon was also of the same dark brown color, and five or six inches of the descending colon were removed, and also both kidneys. The kidneys seemed to be healthy.

Now, the question arises : What was the cause of death in this case ? Before the post-mortem was made I supposed that the uncontrollable straining efforts to vomit had resulted in displacing some of the pedicle ligatures, and that my patient had died of slow internal haemorrhage. But the post-mortem proved otherwise.

In a letter received from Dr. Levis (Feb. 19th) he says :

"It seems to me that the only unpleasant symptoms which could possibly be referred to the anæsthetic were those of the head, and it is evident that the death of the patient is not to be attributed to cerebral causes. As to the diarrhœa or cholericine, which, probably with shock, seemed to cause death, that could not be attributed to the anæsthetic. Ethyl has been used in this city about two hundred times, uniformly with the most happy results. In my experience there has been no headache or other evidence of cerebral disturbance following the administration. No bowel affections have been observed, and none would be thought of. Do not be too hasty in the association of the anæsthetic with the cause of death. Many thousands of patients have died within twenty-two hours after the administration of ether and chloroform."

Some persons think that death was produced by cholericine. Let us sum up the evidence bearing on this point.

The patient took three drachms and fourteen grains of Rochelle salts at 8.30 A.M. It operated freely twice before 11 o'clock, and no more till 7 o'clock, about two hours after the operation. She then had six thin, brownish, watery discharges from the bowels between 7 and 11 o'clock P.M.

—not large, but attended with tenesmus, and the last with a little mucus. At 12.15, 2.40, and at 6 and 7 next morning, there were other thin, watery, brown discharges, with tenesmus and a little mucus, and the patient wanted the bed pan under the pelvis constantly.

Thus, we see that, between 7 P.M., and 7 the next morning, there were not less than ten watery, not profuse, but exhausting evacuations, over which opiates and astringents did not exercise the least influence. Dr. Nash says : "A few hours before death there were several (two or three) large involuntary movements from the bowels, such as she had previously had—dirty, thin water, with the disagreeable ethyl odor." The lower portion of the ileum and the colon were black and congested, and altogether presented an appearance far from a normal, healthy one.

This is a strong array of facts to sustain the theory of death by cholericine ; and in all probability this cholericine had an important bearing on the termination of the case. But from my stand-point of view this was only secondary. Was death, then, caused by the anaesthetic ?

Let us here sum up the evidence bearing on this point.

The patient was under the influence of the anaesthetic for an hour and a half. Its effects were different on her from what has been observed by Dr. Levis and others in Philadelphia. She breathed often sixty times a minute. She had opisthotonic convulsions three times during its administration. When she recovered from its effects she complained all the time of severe pain in the head. She had a congested state of the eyes and eyelids ; and she had convulsions before death ; and the discharges from the bowels smelt so much of the ethyl that the inmates all over the house noticed and complained of its peculiar, disagreeable odor. The woman who washed and dressed the body after death says that the odor of ethyl from the lungs, when she rolled the body over, was as strong as when it was being administered. When we came to make the post-mortem we found the ethyl odor pervading the intestinal canal, and other organs of the body. At 8.45 A.M., the post-mortem was made, and I wrapped up the portions of intestine

removed, the uterus and its appendages, and the kidneys, in a sheet of newspaper, and took them home, and placed them (as I was hurried) on a table in the distal end of my consulting-room, where they lay till 9 P.M.—about eleven hours. During the afternoon and evening the ethyl odor emanating from these pathological specimens was particularly noticeable in the part of the room in which they were laid.

At 9 P.M., they were unrolled in the presence of Dr. Nash and Dr. Gilliam, to be placed in spirits for preservation. When the specimens were examined separately we found the intestine, which had been split open, smelling strongly, not of faeces, nor of dead animal matter, but of the anaesthetic; and when the kidneys, which had been laid open, were brought near the nose, it was almost like smelling ethyl from an open bottle. From this it would seem that every fibre, every tissue of the body, in its minutest parts, was saturated with ethyl.

We know that ænæsthetics, whether ether or chloroform, must be eliminated from the body, and that the lungs and kidneys are the usual emunctories selected by nature for this purpose. But in this case the kidneys were locked up as it were, and hence the bowels were called on to aid the lungs in getting rid of the poison. It is altogether probable that the cholericine was due wholly to the action of the ethyl, and not to the salts, which, as is usual with such a dose, exhausted itself by 11 o'clock in the morning, four and a half hours before the ænæsthetic was given, and eight hours before the thin, brownish, watery discharge began. It is hardly probable—I should say possible—for three drachms of Rochelle salts to produce such a condition of the mucous membrane of the ileum and colon as was found here.

I sent the pathological specimens to Dr. Gilliam for examination on the 12th of February, and I received a verbal report a fortnight afterward saying that the kidneys were healthy. But a few days ago I received the following:

"The kidneys to the naked eye look normal. Under the microscope there was a slight increase of the interstitial

connective tissue. Many of the convoluted tubules showed swollen and coarsely granular epithelia, and considerable narrowed central calibre, a characteristic feature of acute catarrhal nephritis.

"Slight cirrhosis of the kidney, with acute catarrhal nephritis, often exists without marked clinical phenomena, and may be overlooked by the physician."

Now, if this account of the kidneys (which I do not understand) amounts to anything, let us look at the case from this point of view.

Dr. Nash, in his report to me, says :

"From the time she was laid in bed, she was excessively nauseated, and had great restlessness and intense straining efforts to vomit ; her eyes were red, both conjunctivæ and lids, and when asked what pained her, replied, 'Oh ! my head ! my head !!!' When spoken to she would answer intelligently, but at no time addressed any question or conversation to any one.

"After answering questions she would relapse into a state of restlessness and groaning, often throwing her hands up to her head. In order to quiet her, sulph. morph. was given hypodermically, which never completely controlled her. It was difficult for two nurses to keep her covered, on account of constant motion of arms and legs, and rapid turning from side to side for two hours after operation. I frequently asked her if she had pain at the seat of operation, and she invariably replied, 'No, my head !' The expression of face was never natural after operation ; jaws much sunken, and eyes often rolled upward. The discharges from the bowels were saturated with the odor of the ethyl, and the lady of the house and others told me that the medicine we gave her to put her to sleep had gone through her bowels, as they smelt it when the bed-pan was emptied into the closet. Not until about ten hours after the operation did she acknowledge having pain in the abdomen, and that was merely the tenesmus attending the choleric evacuations.

"I never considered her as having entirely recovered from the effects of the anæsthetic. The convulsions consisted in frantic ravings, with agonizing screams ; eyes wide

open, glaring, and intensely red. Then followed a few minutes of quiet, and then death.

"A few hours before death there were several (two or three) large involuntary movements from the bowels, such as she had previously had—dirty brown, thin water, with the disagreeable ethyl odor."

In reading Dr. Nash's report carefully, we are led to ask : "Was this a case of uræmic death ?" We know very well that ether, as an anæsthetic, often proves fatal where there is organic disease of the kidneys. Dr. Emmet was, I believe, the first to impress this on the medical mind.

I have seen two deaths from etherization in women over fifty years of age, where no disease of the kidneys was suspected till fatal coma was produced by the ether. In these cases the secretion of urine was almost instantly arrested, and the little found in the bladder was loaded with albumen. One of these was a patient of Dr. James R. Wood's ; the other, a lady from Brooklyn.

In cases of organic kidney disease, the hydrobromic ether may be just as dangerous as ordinary ether.

In the case under consideration, between the time of operation and death, twenty-one hours after, there were drawn off but five ounces and one drachm of urine, viz :

One ounce at 6.15 P.M., and two ounces at 10.15 P.M., on the 9th ; two ounces at 2.40 A.M., on the 10th ; bladder empty at 8.40 A.M. ; one drachm at 10.30 A.M. ; death at 12.15 P.M.

Of course the purity of the article is essential to safety. Was the ethyl given to my patient pure or impure ? You will perceive what a difference there is in odor between the two. The Wyeth sample is not unpleasant to the smell ; the other is execrable. It is very important to determine this point before we condemn this new anæsthetic. It has many qualities to recommend it : it is easy to administer ; the patient goes quickly under its influence, and recovers rapidly from its effects. But, if it is dangerous, all these qualities pass for naught. Would it be asking too much of the Academy to order an analysis of these two specimens of the hydrobromic ether to be made

for the benefit of the profession at large? If the two are identical in their chemical characters, then I should not advise the use of hydrobromic ether as an anæsthetic. But if it be proven that one specimen contains noxious properties not in the other, then I would advise further experiments with the pure article.

We know that ether is safe in long operations, and that chloroform may be unsafe in short ones. It may be possible that hydrobromic ether will prove safe in short operations, and unsafe in long ones.

In some of Dr. Lawrence Turnbull's cases it produced very distressing effects, which, if prolonged, might have ended, as my case did, fatally.

Dr. Turnbull gave the hydrobromic ether to a nervous, hysterical woman, aged twenty-five (Case 8), for the purpose of replacing a retroverted uterus and adjusting a pessary to hold it in position—Case 8,* “With a little less than one ounce of hydrobromic ether there was produced complete anæsthesia in four minutes, long enough for placing of a pessary to relieve the above symptoms. During the administration the pulse was but slightly accelerated; return of consciousness was accompanied by excessive gagging and vomiting of large quantities of mucous, great burning in stomach and throat, severe headache, cold perspiration, weak and rapid pulse, all of which continued for twenty-four hours, with more or less severity. Both sulphuric ether and chloroform had previously, on several occasions, produced similar symptoms, but not so severely.”

Any agent which in four minutes' time could produce “excessive vomiting, burning in stomach and throat, severe headache, cold perspiration, and a weak and rapid pulse” which continued for twenty-four hours, would, if the anæsthetic had been continued (as in my case) long enough for the whole mass of blood to become poisoned and for every tissue in the body to become saturated with it—would, I say, certainly have ended in the death of the patient.

* Artificial Anæsthesia, etc., 2d edition, p. 74.

Dr. Levis has had a larger experience with this anaesthetic than any other surgeon, but his longest operation was only forty minutes, whereas my unfortunate case lasted an hour and a half. It may be that we did not administer the ethyl as skilfully as it should have been done. But I do not think we could have given less and maintained the anaesthesia sufficient for its purpose.

If the operation had been comparatively short—if it had lasted only twenty or thirty minutes—if it had terminated before my patient's system, solids as well as fluids, became thoroughly saturated with it, she would in all probability have recovered; but, as it was, it seemed to kill by supersaturation which could not be eliminated, even with the aid of the whole mucous tract of the alimentary canal to aid the lungs. If mine had been a short operation, I might today have been lauding the new anaesthetic as a veritable boon to surgery. But, as it was otherwise, I must raise a warning voice, especially in prolonged operations.

It would be an interesting scientific inquiry to determine if ethyl-poisoning by inhalation produces cholericine with a deeply congested condition of the mucous membrane of the lower portion of the alimentary canal, and also to determine what other pathological changes it might induce.

This could easily be done by experiment on the lower animals, and it is to be hoped that some of our physiological *savans* will soon tell us by such experiments what we have to fear from the long continuance of the bromide of ethyl as an anaesthetic.

The inference that I draw from the facts in the history of this case is that the anaesthetic was the cause of death, while the manner of death may have been by uræmic poisoning. The lesson from this is, never to give bromide of ethyl in prolonged operations, and never to give it where there is organic disease of the kidneys. What, then, shall we give? certainly not ether; because we know that it has often precipitated uræmic poisoning and sudden death. Our only resource then in such cases is chloroform as an anaesthetic, because we know that it produces anaemia of the brain, and is therefore less liable to develop uræmic explosion.

THE PRESIDENT, Prof. FORDYCE BARKER, spoke of the importance of the subject, and then called on Dr. Levis of Philadelphia to open the discussion.

DR. LEVIS, after some general remarks said, the only explanation he could give with reference to the difference in results obtained by Dr. Sims and himself was, that there might be a difference in the method in which it was used. He thought that some of the errors were such as he had made in his first cases in which he administered it, when he began very cautiously. He now knew that the proper method of administration was to make a rapid impression, such as was done in giving nitrous oxide gas. He had been able, nearly always, to produce complete anæsthesia, by the use of two drachms, in two or three minutes. He had produced anæsthesia in forty-five seconds; but if the patient could be made to inspire and expire freely, the average time was about three minutes. The only point in Dr. Sims's case which impressed him especially was the duration of the operation, and the large quantity of the anæsthetic used. In his own cases the operation had not lasted more than forty minutes, and the entire quantity of the ethyl used was eleven drachms. He had not seen any after-effects whatever. As to the nausea and vomiting, it perhaps was almost as likely to occur after the use of the ethyl as after the use of ether, if a considerable quantity was given. The quality of the article he regarded as very important, and he was sure that, since he had used Wyeth's preparation, there had been less tendency to nausea. With reference to the persistent odor in the breath, vomited matters, etc., he had noticed it when he had used the same preparation that Dr. Sims used.

THE PRESIDENT. It will be noticed that the symptoms and phenomena manifested differ entirely from the symptoms and phenomena manifested after the administration of any other anæsthetic which has been used. I therefore take the privilege of calling upon Dr. Squibb, of Brooklyn, with the view of receiving an explanation of its failure to be eliminated from the system; that is, whether there are any constituents, either bad or good, in the ethyl, which of itself might destroy life.

DR. E. R. SQUIBB. I fear, Mr. President, I have but little to add to the elucidation of this subject, and I must preface my remarks by saying that all I have to say upon the question is entirely theoretical. I confess to having had a prejudice against this agent from the earliest I knew anything of it, and it is upon theoretical principles, and upon those only, that I am capable of speaking or throwing out hints which possibly may be useful. As a chemical rule, I think that the anaesthetics which are the least dangerous are those which are the most simple, and when decomposed yield elements which, physiologically, are known to be most innocuous. If we commence with the nitrous oxide, we find that it is decomposable only into innocuous elements. If we go one step further and take the oxide of ethyl (and here I wish to protest against the bromide of ethyl being called an ethyl), it can be decomposed into comparatively innocuous elements. In the bromide of ethyl the oxygen of the ordinary ether is replaced by bromine, and the compound contains 73 per cent. of bromine, the other 27 per cent. being the ethyl. Now, when we compare the effects of all the known anaesthetics, we will find that those are more easily borne which are simplest in their nature ; that is to say, the compound ethers are less safe than simple ethers, and both the compound and simple ethers seem to be proportionately safe to the simplicity and innocuousness of the elements of which they are composed.

We all know that bromine is an irritant poison. We all know that bromide of ethyl is a loosely molecular article, is decomposed very easily, much more so than bromides of ordinary bases which act as salts and are eliminated as such. Now we will suppose that the bromide of ethyl, under certain circumstances, is decomposed, and its irritant property, the 73 per cent. of bromine, goes into the system ; it is easy to understand that grave effects might be produced, and perhaps we shall be able in this way to account for the exceptional cases in which the anaesthetic has been used with unpleasant results, whereas, if it had remained as bromide of ethyl, it may not have been harmful.

Let us take an analogy found in chloroform, which con-

tains 89 per cent. of chlorine. Chlorine is one of the organic bodies which does not possess the irritant properties that bromine does, and two atoms of chlorine are not so active in producing toxic effects as one atom of bromine found in the bromide of ethyl. The point can be illustrated still further by supposing the existence of an arsenite of ethyl, the activity of which in producing dangerous effects as compared with the bromide of ethyl would be represented by the difference between the activity of bromine and the activity of arsenic as irritant poisons. If it is admitted that such theoretical argument has any value, I think we could understand some of the dangerous effects produced when compound ethers are used as anæsthetics ; and I think Richardson's observations point us toward the conclusion that compound ethers are less safe than simple ethers, and that simple ethers are less safe still than the oxides. This brings us down to the oxides and nitrogenous oxides of ethyl, which are the safest of all known anæsthetics.

There is another point ; and that is, any agent that can be powerful and active for good, can be powerful and active for evil. We see that in chloroform, and we see it in the bromide of ethyl. I think we can logically argue something from the chemical composition of agents as to which will be useful to us, and especially in the application of agents which carry us so near the dividing-line between life and death.

DR. J. C. DALTON. I should be very happy, Mr. President, to give to the Academy, in response to your invitation, any information, did I have it, with regard to this subject. But unfortunately I am worse off than Dr. Squibb, for I had never seen any hydrobromic ether before this evening. There were some points in Dr. Sims's paper, however, which struck me forcibly, and one is the different kinds of danger which may be developed by different kinds of anæsthetics. I suppose that the profession are tolerably well convinced now that ether, when it is dangerous as an anæsthetic, is mainly so in consequence of the presence of some morbid change in some vital organ ; that when the entire body is perfectly healthy, ether comes as near to being a perfectly

safe anæsthetic as we can have. I do not know of any modification with regard to that statement.

In this case, reported by Dr. Sims, if the death was due to the hydrobromic ether, it was a death which took place long after the substance was administered. It was a death apparently due to the persistent obstinate possession which the bromide of ethyl had taken of the entire system. The system could not get rid of the substance with which it was saturated, and which in some unexplained way produced those symptoms which have been so faithfully detailed. I do not wish to proffer any opinion regarding the cause of death in the case, but it seems that there was a repetition of peculiar symptoms, in the midst of which the patient finally died, and that after death the entire system did retain, during a long period, the bromide of ethyl in sufficient quantity to indicate its active properties. How entirely different deaths from chloroform take place. They occur without any convulsions, without any marked symptoms, and odoriferous bodies of persons who have died under its influence have not been specially observed. I do not suppose, however, we have yet exhausted all the methods by which various anæsthetics are dangerous or may prove fatal. But the difference between the manner in which death is produced by chloroform and by ether when given to animals has, in my experience, been very striking ; so much so that I long ago abandoned the habitual use of chloroform while experimenting, because it was so annoying to lose an animal just before the experiment was required and could not be postponed. Not long since, in order to avoid the disturbance produced by ether, I chloroformed a cat for the purpose of making an ophthalmoscopic examination. With all the recollection of frequent previous disappointment fresh in mind, I was extraordinarily careful in giving the anæsthetic, both with reference to quantity and time occupied in its administration and all the circumstances that could effect the result, and yet, just as I wished to use the instrument, the animal was dead. Here, however, we seem to have another mode of death, and one which, if real, is perhaps as difficult to avoid as sudden death in the use of chloroform.

I am unable to see how any greater care could have been used than was exercised by Dr. Sims, although it is possible that Dr. Levis, who has a much greater experience in the use of the agent, might point out some improvement in the method adopted.

DR. A. C. POST remarked, with reference to the prolonged action of anæsthetic agents, that he had been in the habit, for several years, in cases in which he anticipated a long operation, to use Prof. Nussbaum's method, premising the use of the anæsthetic by the hypodermic injection of seven or eight minims of Magendie's solution of morphia. He had found by so doing that the anæsthetic effect could be kept up for a long time with more quietude and less quantity of the anæsthetic than where the morphia had not been thus administered, and he was inclined to think it added to the safety of the patient as well as to the comfort of the surgeon.

DR. PIFFARD said he had no experience with the bromide of ethyl; had never seen it till yesterday; from what he had heard to-night he did not think he would be justified in using it as an anæsthetic; and that he would now sell it very cheaply.

DR. JAS. L. LITTLE referred to two cases, as follows: CASE I.—Last Tuesday, having received a specimen of the bromide of ethyl from Wyeth of Philadelphia, he determined to test its anæsthetic properties, and accordingly gave it to a boy three or four years old, upon whom he proposed to perform Heaton's operation for the radical cure of hernia. The ethyl was administered in the manner proposed by Dr. Levis; probably less than *two* drachms were used, and the patient went under its influence in less than two minutes. The pupils were contracted. Within five minutes after the cloth was removed from his face the child was able to respond intelligently. There was no vomiting.

CASE II. An adult, in good condition, had two or three drachms held close over his mouth and nose on a napkin, and at the end of three minutes no special effect had been produced by the anæsthetic except to excite powerful struggling on the part of the patient. The ethyl was applied more freely, the patient struggled very violently, the face

was suffused, not however like that seen in ether inhalation ; the pupils dilated and contracted alternately, the eyeballs rolled about ; and at the end of *eight* minutes Dr. Little became somewhat alarmed at the condition of the man and discontinued the ethyl. The patient seemed, within three or four minutes, to come from under what influence of the anaesthetic he had received. The quantity used was *two ounces* and *two drachms* by weight, and the time occupied *eight* minutes. There was neither nausea or vomiting. Both the pulse and the respiration became exceedingly rapid. The condition was entirely different from anything he had ever seen in connection with the inhalation of either chloroform or ether. Ether was subsequently administered, and the operation performed.

THE PRESIDENT. It will be noticed that Dr. Sims reported in his case that the respiration became exceedingly rapid. In the administration of this anaesthetic it seems, from what has been said, that it is necessary to produce its anaesthetic effect as rapidly as possible ; that no atmospheric air is admitted, or just as little as possible. Of course, associated with this is another influence. We know that the exhalation of carbonic acid gas is limited, and, therefore, the question naturally arises : May not that fact be one which contributes to the danger ; may not a part of the poisoning be due to the carbonic acid gas ? I will next call upon Dr. Wylie, who has had experience with Dr. Sims in the administration of this agent.

DR. WYLIE, remarked that he had nothing to add to the details of the case which Dr. Sims had reported, except that he endeavored to follow Dr. Levis's directions regarding the mode of administration, in the most exact manner. In three cases in which he had administered it he had seen the muscles in general convulsed. He was satisfied that hydro-bromic ether could not be used as an anaesthetic with the same freedom as could ether. He had not had any difficulty in administering either chloroform or ether, having used both many hundreds of times, yet it was just possible that he failed to give a sufficiently large quantity of the ethyl just at the beginning. He could see no other expla-

nation for his failures in attempting to produce safe anaesthesia with the new agent.

DR. SQUIBB made special reference to two points: 1. In many substances employed, the anaesthesia is separate from other effects produced by the agent. Therefore, it is necessary to be cautious in regarding the disappearance of the anaesthesia as the disappearance of the entire effects of the agent; that is to say, the disappearance of the anaesthesia suddenly after the administration of the agent has ceased does not indicate that the effect produced by the anaesthetic has passed away. 2. Many of the symptoms in Dr. Sims's case looked very much like those belonging to bromine poisoning. If it was a case of poisoning by bromine, that fact was to be separated from the known character of the agent as an anaesthetic. A better illustration of the effects of an irritant poison, he thought, could hardly be found, not only upon the alimentary canal, but also upon the kidneys. The idea that the organic condition of the kidneys, discovered only by the microscope—and that after they had once been thought to have been healthy—was a condition that had anything to do with producing the death of the patient, did not look probable in view of the presence of other well-marked irritant symptoms. He would say, therefore, that he should abstract the anaesthetic element altogether from the case, and study it as a simple case of irritant poisoning. The color of the eyes, and their peculiar movements, and the intense pain in the head, together with the other symptoms, pointed directly to the irritant effect of some such agent.

DR. ROBERTS, of Philadelphia, on invitation, remarked that he had administered the bromide of ethyl many times as an anaesthetic, both for Dr. Levis and in his own practice, yet he had nothing special to add to what had already been said. He had had no experience whatever in the use of chloroform, and therefore was unable to compare the bromide of ethyl with that agent. His own experience with ether had been that it was a safe anaesthetic, sometimes, however, requiring large quantities to produce the desired effect. The most troublesome symptom he had

observed with ether was the expectoration of large quantities of mucus and the existence of coarse bronchial râles, due to hypersecretion into the bronchial tubes. He always felt specially disturbed with reference to the respiration of a patient inhaling ether. One of the chief benefits arising from substituting the bromide of ethyl for ether was that the ethyl affected the respiration but little, except to a certain extent, to increase its frequency. In no case had he seen hypersecretion of mucus, such as was so annoying in etherization, when bromide of ethyl was used. As a rule the pupils had been dilated during the period of the most profound anaesthesia. It was a little difficult to judge of the pulse. The eyes were not so suffused as in etherization. As a rule, patients had come from under its influence promptly. In two cases he had observed nausea. He was not at all an advocate for the agent, but simply felt interested in assisting to place it upon record as an anaesthetic that had been used successfully. He thought it possible that in Dr. Sims's case sufficient stress had not been laid upon the operation itself as a factor in producing the death of the patient, as some deaths had followed the abdominal incision for removal of the ovaries, or Battey's operation. With reference to the tetanic convulsions, he thought they were not infrequently seen in connection with the use of ether. He also called to mind a case in which the patient had severe convulsions occurring with etherization, and it was subsequently found that the patient was an epileptic. It was possible that some such influence might have been at work in Dr. Sims's case. He thought that it might be difficult to use the ethyl in plastic operations about the face, because its effects were so evanescent.

The Academy then adjourned.

